AD-A174 218 DRIVER TRANER TRAINING DEVELOPMENTS STUDY FOR M113 1/1
FAMILY OF VEHICLES(U) ARMY INFANTRY SCHOOL FORT BENNING
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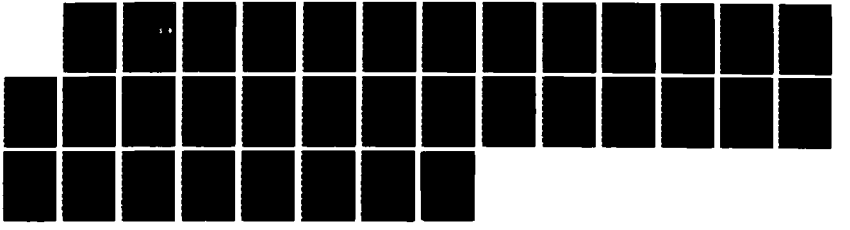

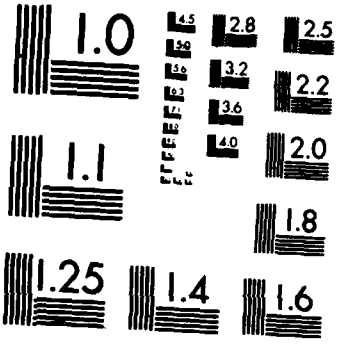

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DRIVER TRAINER

TRAINING DEVELOPMENTS STUDY FOR

M113 FAMILY OF VEHICLES

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July 1986

Analysis and Studies Office
Directorate of Training and Doctrine
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Ft Benning, GA

STUDY GIST
DRIVER TRAINER TRAINING DEVELOPMENTS STUDY FOR M113 FAMILY OF VEHICLES

PRINCIPAL RESULTS: No specific performance deficiencies for M113 FOV driving tasks/subtasks were identified. No tasks were selected for training via simulation. No savings of training dollars nor significant reduction in OpTempo would occur with a driver trainer. Units lack adequate time for driver training on either a simulator or vehicles. A driver trainer could present a more standardized program of driving instruction. RC units do not have adequate local training sites for driver training; however, once trained, the soldier tends to remain in that position for several years; and a driver trainer for the RC would be idle for as much as 28 days each month.

MAIN ASSUMPTIONS: Information provided by SMEs, TCs, and drivers was valid for applying the ARI process to select tasks to be trained via simulation. Identified driving tasks were those most likely to be encountered in war or normal operations. Driving instruction is standardized across all units; therefore, data collected in mechanized units were typical of all tracked vehicle driving instruction. Infantry OSUT driving instruction was typical of institutional training.

MAJOR LIMITATIONS: Budget restrictions dictated data collection at the nearest FORSCOM installation with no input from USAREUR or WESTCOM. There was no attempt to differentiate among driving tasks on the various models. No formal test of driver proficiency was conducted.

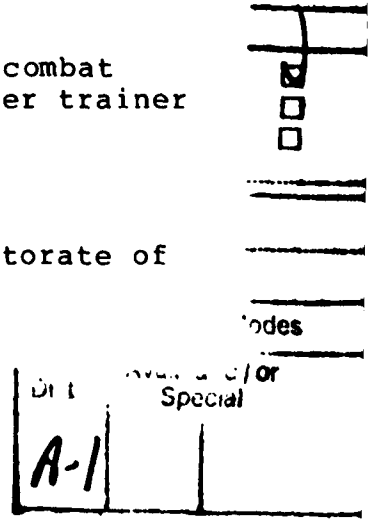
SCOPE OF THE STUDY: Examined driver training at USAIS/C, FORSCOM, and RC units. Input from battalion command and staff officers, company commanders, TCs, and drivers. Other data concerned accident rates, OpTempo, and estimated costs associated with driving simulators.

METHODOLOGY: Identified tracked vehicle driving tasks and subtasks, and assessed the effectiveness of driving instruction in reserve and active army units by questionnaires and interviews with command, supervisory, and tracked vehicle crew personnel. Estimates were made of driving training costs at the institution and in the units, with and without simulators. Driving tasks were subjected to an analytic process for selection to be trained via simulation.

REASON FOR PERFORMING THE STUDY: All proponents of tracked combat vehicles were tasked by CAC to determine the need for a driver trainer in light of OpTempo restrictions and reducing O&S costs.

STUDY PROPONENT: USAIS, Ft Benning, GA.

STUDY PERFORMING AGENCY: Analysis and Studies Office, Directorate of Training and Doctrine, USAIS, Ft Benning, GA.



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DRIVER TRAINER
TRAINING DEVELOPMENTS STUDY FOR
M113 FAMILY OF VEHICLES

1. INTRODUCTION. The operation of large numbers of tracked combat vehicles in the U.S. Army demands vast training areas and resources, both in personnel and materiel. Considering Soviet forces' reliance on tank and mechanized infantry tactics to overwhelm or circumvent Allied armies' defenses, much time must be devoted to training counter-moves and attack strategies. The training of crews to man U.S. Army tracked combat vehicles, especially those soldiers who are new to mechanized infantry concepts, draws on needed resources that might otherwise be used in advanced tactics and sustainment training. An integral and vital part of tracked vehicle crew instruction is that segment devoted to the training of the driver.

a. PURPOSE. On 25 Oct 85, Combined Arms Center (CAC), tasked proponents of tracked combat vehicles to conduct a TDS to determine the need for developing and fielding a tracked vehicle driver trainer. The Infantry Branch as proponent for the M113 FOV dictated the TDS to include the following vehicles: M106, 107mm Mortar Carrier; M113, Armored Personnel Carrier (APC); M125, 81mm Mortar Carrier; M577, Command Post; and the M901, Improved TOW Vehicle (ITV).

b. PROBLEM.

(1) Implementation of the Standards in Training Commission and an Armywide emphasis to reduce operating tempo (OpTempo) expenses have prompted the development of alternative methods of training combat units to high standards of readiness at less cost. In an effort to reduce vehicle operating costs, it was perceived that drivers of tracked vehicles might be trained by using a driving simulator rather than the present mode of instruction which relies on operation of the actual vehicle.

(2) The CAC message implied that a full task, full motion simulator would be the type of device to adequately prepare drivers for achieving the training required to safely operate tracked vehicles in any mission. The high cost of obtaining such a device (estimated at over one million dollars per copy) prompted CAC to promote development of a generic driver trainer capable of replicating the driver's compartment and controls of the particular vehicle to be trained. As conceived, the driver's compartment would be mounted on a full motion platform capable of duplicating many of the sensations and situations a tracked vehicle driver might encounter. Visual and audio presentations would coincide with the particular action being trained. A system of evaluating the driver's performance would also be incorporated, thereby promoting a degree of standardization in the driving instruction program.

c. IMPACT OF THE PROBLEM. Continued high operating and support (O&S) costs and a subsequent limit on vehicle operation could severely curtail the amount of training for active army and reserve component (RC) soldiers at a time when maximum strength and preparedness are required.

2. SCOPE. The study addressed the tasks and events directly related to vehicle movement; training of the driver at the institution and in RC and active army units; costs associated with present driving instruction; the effectiveness of that instruction as evidenced in vehicle malfunctions or accidents caused by incorrect driving actions; command and supervisory views of driver training; vehicle usage for driver training; and estimated costs of driver trainers. Unless otherwise stated, the terms "M113" and "APC" and the results of this study apply to the following tracked vehicles:

M106/A1/A2	Mortar Carrier, 107mm
M113/A1/A2	Carrier, Personnel, Full Tracked Armored (APC)
M125/A1/A2	Mortar Carrier, 81mm
M577/A1/A2	Command Post
M901/A1/A2	Improved TOW Vehicle (ITV)

a. LIMITS.

(1) Budget restrictions dictated data collection at the nearest United States Army Forces Command (FORSCOM) installation with no input from United States Army, Europe (USAREUR) or United States Army Western Command (WESTCOM).

(2) As each of these M113 vehicles is driven in a similar manner, there was no attempt to differentiate among driving tasks on the various models.

(3) No formal tests of driver proficiency were conducted.

b. ASSUMPTIONS.

(1) Information provided by subject matter experts (SME), drivers, and track commanders (TC) was valid for the Army Research Institute (ARI) process in selecting driving tasks/subtasks to be trained on a simulator.

(2) Tracked vehicle driving tasks identified in the study are those most likely encountered in war or normal operations.

(3) Driving instruction procedures are standardized across all units using the subject vehicles; therefore, units selected for data collection were typical of all tracked vehicle driving instruction.

(4) The observation of one-station-unit-training (OSUT) driving instruction was typical of institutional training.

3. OBJECTIVES.

a. Identify deficiencies in driver training.

b. Determine driving tasks that should be trained on a driver trainer.

c. Determine if a driver trainer would be a cost saving mode of instruction for M113 FOV drivers.

4. ESSENTIAL ELEMENTS OF ANALYSIS (EEA).

a. EEA 1. What driving tasks does a tracked vehicle driver perform?

- A list of driving tasks/subtasks was compiled from training publications, field manuals, technical manuals, and SME input.

b. EEA 2. Where are tracked vehicle drivers trained?

- Institutional driving instruction was observed, programs of instruction (POI) were examined, and interviews were conducted with national guard (NG) and active army mechanized infantry and armor units.

c. EEA 3. What is the effectiveness of tracked vehicle driver training at the institution and in mechanized infantry units?

- Accident reports were obtained from the U.S. Army Safety Center. The approximate number of vehicles in the M113 FOV was obtained from the United States Army Tank and Automotive Command (TACOM). Verification of accidents occurring in units and the institution was determined by interviews with command and supervisory personnel. Mechanical malfunctions caused by improper driving procedures were also investigated.

d. EEA 4. What driving tasks/subtasks or skills should be trained on a driver trainer?

- Data were collected by interviews and questionnaires administered to command, supervisory, and maintenance personnel.

- Data were obtained from driving instructors, drivers, and track commanders. An SME panel composed of representatives from active army, NG, and army reserve mechanized units was held. The results were applied in an analytic process to determine the tasks that should be trained on a driving simulator.

e. EEA 5. What alternatives are available for driver training?

- Other alternatives for driving instruction were determined from a review of literature, suggestions from various TCs, training personnel, and data collected during interviews with command and supervisory personnel.

f. EEA 6. What is the cost of present driving instruction at the institution and in the units?

- Costs of vehicle operation for driver training at the institution, in active army, and RC units were estimated.

g. EEA 7. What is the estimated cost of a driver trainer?

- The estimated cost of procurring and operating a driver trainer was determined.

h. EEA 8. What are the estimated comparative costs of driver training using actual vehicles and a driver trainer?

- Costs of present driving instruction on actual vehicles were compared to that conducted on a driver trainer.

5. METHODOLOGY.

a. INSTITUTIONAL TRAINING AT FT BENNING. Driver training in OSUT was observed. Time and miles driven per student driver were logged.

b. UNIT TRAINING. Estimates of driver training hours and miles were obtained based on data supplied by drivers, TCs, and supervisory personnel in the course of conducting interviews and administering questionnaires. Detailed demographics of the sample are at Appendix A. Sample size is indicated in Table 1. Twenty-five percent of TCs and 18% of drivers were NG personnel. Data collection forms are at Appendix B.

c. MAINTENANCE RECORDS. Units participating in the study provided information on assigned vehicles. Vehicle use data were compiled from current odometer reading and date placed in service.

d. OTHER DATA SOURCES. TACOM provided M113 FOV fleet-wide data on O&S costs and OpTempo limits. United States Army Safety Center provided accident reports on subject vehicles. Costing data on the driver trainer was provided by the Office of the Project Manager for Training Devices (PM TRADE).

Table 1

SAMPLE SIZE

	ACTIVE COMPONENT	NATIONAL GUARD	TOTAL
Battalion Commanders	0	1	1
Battalion Executive Officers	1	Ø	1
S-3 Operations Officers	2	1	3
Battalion Maintenance Officers	2	1	3
Company Commanders	4	1	5
Tracked Vehicle Commanders	12	4	16
Tracked Vehicle Drivers	14	3	17
TOTAL			46

6. DATA ANALYSIS AND RESULTS.

a. EEA 1. What driving tasks does a tracked vehicle driver perform?

(1) Major driving tasks were extracted from soldier's training publications (Soldier's Manuals) for 11B, 11C, and 11H. The descriptions of driving tasks contained in these publications were somewhat limited for the purposes of this study. Therefore, it was necessary to identify subtasks, conditions, and other events that the tracked vehicle driver might encounter. Further analysis of field manuals resulted in the driver task/subtask list in Table 2.

(2) Opportunity was provided for respondents of questionnaires and SMEs to expand the driving task list; however, no other tasks or subtasks were added. This list was presented to tracked vehicle drivers with a series of questions designed to identify the percentage of drivers performing the tasks, where the task/subtask was first learned, their opinion of where the task should be trained, the degree of difficulty in learning the task, the degree of difficulty in performing the task, the frequency of performance, and their opinion of how often the task needs to be trained for sustainment.

(3) Table 3 presents a tabulation of the percentage of NG drivers performing the driving tasks and the category of performance (annually, monthly, or weekly) in which approximately 50% of the drivers responded. Table 4 presents a similar tabulation for FORSCOM drivers.

Table 2

DRIVING TASKS/SUBTASKS FOR TRACKED COMBAT VEHICLE DRIVERS

TASK #	DESCRIPTION
1	Operate intercom
2	Start track using normal start
3	Start track using auxiliary start
4	Start track using tow start
5	Drive track in urban area
6	Drive track in desert area
7	Drive track in wooded area
8	Drive track on slopes
9	Drive track on snow/ice/rain slick roads
10	Drive track in water less than 3.5 feet
11	Swim the tracked vehicle
12	Drive track using night vision equipment
13	Drive track in mined area
14	Drive track in column formation
15	Drive track in wedge formation
16	Drive track in vee formation
17	Drive track in line formation
18	Drive track in echelon formation
19	Drive track to a coil halt
20	Drive track to a herringbone halt
21	Perform evasive tactics on track
22	Tow a disabled vehicle
23	Load track on transporter, rail car, plane
24	Maintain a stable platform for firing
25	Perform pivot turns with track
26	Drive the track over a bridge
27	Drive the track over vertical obstacle
28	Drive the track up a steep hill
29	Drive the track down a steep hill
30	Drive the track over soft terrain
31	Drive the track in a road march (convoy)
32	Drive the track across ditches or ravines
33	Drive the track to a hull down position
34	Leave/enter a concealed/camouflaged position
35	Stop/shut down the track

Table 3

PERFORMANCE OF TRACKED VEHICLE DRIVING TASKS/SUBTASKS
RESPONSES OF DRIVERS IN NG MECHANIZED UNITS

TASK DESCRIPTION	PERCENTAGE PERFORMING	FREQUENCY OF PERFORMANCE
Operate intercom	100	Annually
Start track using normal start	100	Annually
Drive track in wooded area	100	Annually
Drive track on slopes	100	Annually
Drive track in water less than 3.5 feet	100	Annually
Drive track in column formation	100	Annually
Drive the track over a bridge	100	Annually
Drive the track over soft terrain	100	Annually
Leave/enter a concealed/camouflaged position	100	Annually
Stop/shut down the track	100	Annually
Start track using auxiliary start	67	Annually
Drive track in desert area	67	Annually
Drive track on snow/ice/rain slick roads	67	Annually
Drive track using night vision equipment	67	Annually
Drive track in wedge formation	67	Annually
Drive track in vee formation	67	Annually
Drive track in line formation	67	Annually
Drive track in echelon formation	67	Annually
Perform evasive tactics on track	67	Annually
Tow a disabled vehicle	67	Annually
Maintain a stable platform for firing	67	Annually
Perform pivot turns with track	67	Monthly
Drive the track up a steep hill	67	Annually
Drive the track down a steep hill	67	Annually
Drive the track in a road march (convoy)	67	Annually
Drive the track across ditches or ravines	67	Annually
Drive the track to a hull down position	67	Annually
Drive track in urban area	33	Monthly
Drive track in mined area	33	Annually
Drive track to a coil halt	33	Annually
Drive track to a herringbone halt	33	Annually
Load track on transporter, rail car, plane	33	Annually
Start track using tow start	0	---
Drive the track over vertical obstacle (wall)	0	---
Swim the tracked vehicle	0	---

NOTE: Annually - 1 to 4 times per year
Monthly - 1 to 4 times per month
--- - not performed

Table 4

PERFORMANCE OF TRACKED VEHICLE DRIVING TASKS/SUBTASKS
RESPONSES OF DRIVERS IN FORSCOM MECHANIZED UNITS

TASK DESCRIPTION	PERCENTAGE PERFORMING	FREQUENCY OF PERFORMANCE
Start track using normal start	100	Weekly
Drive track in wooded area	100	Monthly
Drive the track up a steep hill	100	Monthly
Drive the track down a steep hill	100	Monthly
Drive the track in a road march (convoy)	100	Monthly
Stop/shut down the track	100	Weekly
Operate intercom	93	Weekly
Drive the track over a bridge	93	Monthly
Drive track on slopes	93	Monthly
Drive track in water less than 3.5 feet	93	Annually
Drive track in column formation	86	Monthly
Load track on transporter, rail car, plane	86	Annually
Drive the track over soft terrain	86	Monthly
Drive the track across ditches or ravines	86	Monthly
Start track using auxiliary start	79	Monthly
Drive track on snow/ice/rain slick roads	79	Annually
Drive track in line formation	79	Annually
Leave/enter a concealed/camouflaged position	79	Annually
Tow a disabled vehicle	71	Annually
Perform pivot turns with track	64	Annually
Drive track in desert area	57	Annually
Drive track in wedge formation	57	Annually
Maintain a stable platform for firing	57	Annually
Drive track in urban area	50	Annually
Drive track using night vision equipment	50	Annually
Drive track to a herringbone halt	50	Annually
Perform evasive tactics on track	50	Annually
Drive track in vee formation	43	Annually
Start track using tow start	36	Annually
Drive track in echelon formation	36	Annually
Drive track to a coil halt	36	Monthly
Drive the track to a hull down position	36	Annually
Swim the tracked vehicle	29	Annually
Drive track in mined area	29	Annually
Drive the track over vertical obstacle (wall)	29	Annually

NOTE: Annually - 1 to 4 times per year
Monthly - 1 to 4 times per month
Weekly - 1 to 4 times per week

(4) In NG units, 86% of the driving tasks were performed from one to four times per year (annually). Nine percent of the tasks were performed one to four times per month (monthly) and 5% were never performed. In comparison, FORSCOM drivers perform 60% of the tasks on an annual basis, 21% were performed monthly, and 9% were performed on a weekly basis (one to four times per week).

b. EEA 2. Where are tracked vehicle drivers trained?

(1) Institution.

(a) Task/site selection boards for Military Occupational Speciality (MOS) 11B/C/H recommended training of tracked vehicle drivers be conducted in the unit to which the soldier is assigned. This is the general guidance that is followed, although some introductory tasks for preventive maintenance, checks, and services (PMCS), and limited driving of a tracked vehicle are conducted in OSUT.

(b) Infantry OSUT prepares soldiers for skill level one tasks including basic driving skills. Soldiers completing the Infantry OSUT course and reporting to a mechanized infantry unit will not, in most cases, be the primary driver in their assigned track. However, knowledge of how to operate the track would prove to be very useful in many situations, particularly where the primary driver is incapacitated and survival depends on prompt but knowledgable action by some other squad member.

(c) Infantry OSUT driving instruction student to instructor ratio is 9:1. Driving instruction was observed in which ten M113 vehicles were used for the 93 soldiers--seven squads of nine soldiers each and three squads of ten soldiers. One 10-hour day was devoted to driver training. A typical group instruction began with a safety briefing and PMCS preoperation checks. A brief lecture was presented by the instructor to five soldiers on how to drive the M113 including start, lower the ramp, how to turn, slow down, and stop the track. Each of these five soldiers was given the opportunity to practice these events. After these five soldiers completed the orientation, the remaining four soldiers were indoctrinated in the same manner. When all nine soldiers completed the orientation, the vehicle moved to the driving course. The soldiers were not permitted to drive over 8 mph on the 2-mile course which consists of right and left curves, dips, hills, water less than 3.5 feet deep, up and down slopes, and trees. No reverse driving was practiced. Each OSUT soldier drove the 2 miles with a class average of 12 minutes per soldier. None of the above events was tested. In the squad attack block of instruction, one of the students was designated as the driver and achieved an additional 2.8 miles of driver training. A longitudinal study of the percentage of students completing OSUT instruction and eventually become tracked vehicle drivers was not possible.

(2) Unit. Driver training and licensing is a function delegated to the units. This practice was generally agreed to by command and supervisory personnel participating in the study. While the situation appears to be adequate, there is some feeling that once a driver is trained to proficiency, a skill identifier should be included as part of his MOS. The majority of driver training occurs with on-the-job-training (OJT) or in conjunction with other mounted training and, typically, is not an isolated training event in unit training schedules. During the course of conducting interviews, much concern was expressed for the lack of time to devote to driver training. It is logical to assume that if there is not sufficient time to devote to driver training on the actual vehicle, then no time would be alloted for training on a driver trainer.

(a) Units of the NG are at a particular disadvantage for conducting driver training with minimum tracked vehicles, usually three, maintained at local armories. Most vehicles are kept at distant training locations used for annual training. Local armories are also hindered by lack of a suitable site for driver training other than the motor pool or perhaps a small field located near the armory. Those armories that have adequate driver training sites are in the minority. Interviews with NG personnel indicated that as much as 6-9 months may pass before drivers come in contact with their vehicles. While some battalions have a standing policy to interact with the vehicles at least once a quarter, other units may not have that same frequency due to dismounted or other training priorities. NG mechanized infantry units that took part in the study had conducted recent iterations at the National Training Center (NTC) Ft Irwin, CA. As a result of that training, more emphasis was placed on driver training.

(b) Army Reserve mechanized infantry units were not directly involved in the course of the study. Representation of this population was provided only through SME participation on the panel for selecting tasks to be trained on a driver trainer.

(c) A positive aspect of RC training is that of a low percentage of turbulence in the driver position, estimated by command personnel at less than 5% per year. Once a driver is trained and licensed, he tends to remain in that position for several years. Loss of drivers is primarily due to promotion or civilian employment transfer.

c. EEA 3. What is the effectiveness of tracked vehicle driver training at the institution and in mechanized infantry units?

(1) Institution. All soldiers in Infantry OSUT are given introductory presentations and opportunity for a brief period of hands-on experience in the driving of M113s. No major accidents have occurred in this block of instruction. Driver performance

is not tested during institutional training and no special assessment of driver proficiency was made for purposes of this study.

(2) Unit.

(a) RC units do not have the opportunity to train as often as FORSCOM units. Table 5 indicates discrepancies occurring between frequency of performance and recommended sustainment frequency as determined by approximatley 50% of NG drivers in the respective category. Three tasks were never performed--start track using tow start, swim the tracked vehicle, and drive the vehicle over a vertical obstacle. Three other tasks were recommended for less frequent training.

(b) Table 6 indicates discrepancies occurring between frequency of performance and recommended sustainment frequency as determined by approximatley 50% of FORSCOM drivers in the respective category. Four tasks were selected for more frequent training--perform evasive tactics, drive over vertical obstacles, drive to a hull down position,and leave/enter a concealed/camouflaged position. Five tasks were recommended for less frequent training--start with auxiliary start, drive track to a coil halt, drive the track over a bridge, drive the track in a road march, and stop/shut down the track.

(c) Drivers were asked to identify the most difficult part of learning to drive their tracked vehicle. Six percent of the drivers indicated they had no problems with operating the tracked vehicle. Table 7 displays their responses and the percentage of drivers concurring.

(d) TCs were asked to note driver deficiencies and to identify characteristics of a good driver. Positive driver characteristics are listed in Table 8. Deficiencies are identified in Table 9.

Table 5

DISCREPANCY OF PERFORMANCE VERSUS RECOMMENDED SUSTAINMENT FOR M113 FOV DRIVING TASKS/SUBTASKS (NG DRIVERS)

TASK DESCRIPTION	FREQUENCY OF PERFORMANCE	RECOMMENDED SUSTAINMENT
Drive track in urban area	Monthly	Annually
Load track on transporter/rail car/plane	Monthly	Annually
Perform pivot turns with track	Monthly	Annually

Table 6

DISCREPANCY OF PERFORMANCE VERSUS RECOMMENDED SUSTAINMENT
FOR M113 FOV DRIVING TASKS/SUBTASKS
(FORSCOM DRIVERS)

TASK DESCRIPTION	FREQUENCY OF PERFORMANCE	RECOMMENDED SUSTAINMENT
Perform evasive tactics on track	Annually	Monthly
Drive the track over vertical obstacle	Annually	Monthly
Drive the track to a hull down position	Annually	Monthly
Leave/enter a concealed/camouflaged position	Annually	Monthly
Start track using auxiliary start	Monthly	Annually
Drive track to a coil halt	Monthly	Annually
Drive the track over a bridge	Monthly	Annually
Drive the track in a road march (convoy)	Monthly	Annually
Stop/shut down the track	Weekly	Monthly

Table 7

DRIVERS' RESPONSES TO MOST DIFFICULT ASPECT OF LEARNING TO DRIVE

DESCRIPTION	% RESPONDING
Performing PMCS	17
Using night vision equipment/periscope	17
Selecting appropriate gear ratio	12
Encountering obstacles	12
Distance perception on right side of vehicle	12
Maintaining position in road march	6
Evasive tactics	6
Driving in reverse	6
Poor introduction to vehicle	6

(e) Nineteen percent of TCs indicated they were not able to pinpoint any driving deficiency in their drivers. Performing PMCS is one task many drivers considered to be the most difficult part of learning their position, the same item that TCs identified as a good driver characteristic, and as a deficiency in drivers not properly performing the duties of their position. This is an

indication that drivers must be properly indoctrinated in the elementary mechanic tasks required in performing PMCS. The extent of training needed in this area was not determined; however, the driver trainer is not considered a maintenance training aid. Use of a driver trainer could assist in driving at night. Proper PMCS and driving too fast for conditions are more properly remedied by closer supervision, not by a driver trainer. As units are limited in the amount of time for driver training, it is evident that additional time would not be alloted to driver training even if a simulator were available.

Table 8

POSITIVE DRIVER CHARACTERISTICS AS IDENTIFIED BY TRACK COMMANDERS

CHARACTERISTIC	% RESPONDING
Perform proper PMCS	56
Demonstrate initiative	32
Good map reader	6
Attentive, follows commands	6

Table 9

DRIVING DEFICIENCIES AS NOTED BY TRACK COMMANDERS

DEFICIENCY	% RESPONDING
Improper or poor PMCS/Not using TM	25
Driving too fast for conditions/inattention	25
Night driving	19
Not enough training	12

(f) Battalion commanders, operations officers, and company commanders split evenly on whether terrain/obstacle driving was more difficult than tactical driving. With regards to present driver training strategy (introductory presentation in OSUT with more complete training and licensing in the unit), 60% were of the opinion that this plan should remain in effect. Strong verbal expressions of other alternatives were: adding a skill identifier to the soldiers' MOS, a tracked vehicle drivers' badge with rigid requirements for awarding same, and more driver training in advanced infantry training even to the point of being fully trained and licensed drivers.

(3) Accidents. Information was obtained from TACOM on the number of M113 vehicles to determine accident rates per vehicle type. Figures were current as of 31 Dec 1985. (Table 10).

Table 10

NUMBER OF M113 FOVs

VEHICLE TYPE		NUMBER OF VEHICLES
M106	Mortar Carrier	1,613
M113	Armored Personnel Carrier (APC)	22,112
M125	Mortar Carrier	1,438
M577	Command Post	4,642
M901	Improved TOW Vehicle (ITV)	1,711
	TOTAL	31,516

(a) M113 FOV accident reports for a 3-year period (1 November 1982 to 31 October 1985) were obtained from the U.S. Army Safety Center. The pertinent information derived from these reports is depicted in Table 11.

(b) In the M113 FOVs, the overall percentage of accidents is 1.8. This was determined by dividing the total number of accidents by the total number of vehicles in operation during the designated time span. The M113 vehicle has the highest number of accidents, but when compared to the number of vehicles of that type, the percentage is comparable to that of the entire FOV. The 3.3% of accidents of the ITV may be attributable to the high center of gravity caused by the TOW turret.

(c) A relatively high accident percentage for M113 and M125 vehicles, exceeding 20% of the total accidents for these vehicle types, was caused by drivers. Accidents caused by M901 drivers also approaches the 20% mark. As determined from the accident reports, the primary factors in accidents caused by drivers are misjudgement of distance or terrain, and driver inattention. An additional contributing factor is vehicle operation by unlicensed drivers. Adherence to criteria found in FM 21-17 Driver Selection, Training and Supervision--Track Combat Vehicles may result in selecting soldiers who are better equipped to assess depth and distance and not be diverted from the task at hand.

Table 11

NUMBER AND PERCENTAGE OF TRACKED COMBAT VEHICLE ACCIDENTS
(1 NOVEMBER 1982 - 31 OCTOBER 1985)

VEHICLE TYPE	NUMBER OF ACCIDENTS	% OF ACCIDENTS P/VEHICLE TYPE	% OF ACCIDENTS CAUSED BY DRIVERS
M106	30	1.9	13.3
M113	392	1.8	26.0
M125	10	.6	30.0
M577	83	1.8	14.5
M901	57	3.3	19.3
TOTAL	572		

Note. The percentage of accidents per vehicle type was tabulated by dividing the number of accidents by the number of vehicles of that type. The percentage of accidents caused by drivers was determined by dividing the total number of accidents caused by drivers, as identified in the accident reports of a particular vehicle type, by the number of accidents of that vehicle type.

(d) Accident reports also included information on 14 fatalities, 12 of which occurred in APCs. Five of the fatalities were a result of driver actions. Causes were: depressed brake lock button on top of right lateral and speeding, a non-licensed driver operating the vehicle in a field location, operating vehicle too fast for conditions (speeding) with near zero illumination, operation of vehicle in darkness with poor visibility, and poor visibility with over correction of steering causing vehicle to roll over. These causes among other factors are verified by an article appearing in the October, 1985 issue of Countermeasure. No fatalities have occurred in the M577 or M901 vehicles.

(e) A 1-year (1 Nov 84-31 Oct 85) tabulation of M113 APC accidents resulted in 187 incidents, 28% related to driver error. Total lost days during this time span were 1,701 at a cost in excess of $1M with 3 fatalities and vehicle damage of approximately $.06M.

(4) Mechanical malfunctions due to improper driver actions.

(a) Battalion maintenance officers and maintenance technician supervisors were queried as to recurring maintenance problems related to lack of driver skill. Improper PMCS and not

checking fluid levels had resulted in various mechanical problems including broken final drives, blown engines, and broken drive trains. No other malfunctions were specifically identified as being directly related to operators driving skills. Broken or thrown tracks, sprocket bolts shearing off, inoperative laterals, overheating and locking of differential, and defective governors causing engine to exceed braking capacity were other identified material problems. Corrective actions for these malfunctions are: ensuring proper before-, during-, and after-operation PMCS, being safety conscious and anticipating possible equipment malfunctions, and not using the brakes if the vehicle throws a track while in operation but to let off the accelerator and allow the vehicle to coast to a stop.

(b) Improper PMCS is not correctable by a driver trainer, but demands closer supervision by the TC. Other suggestions for improving driver training were: practice of recovery techniques, cross-country navigation, and limited visibility driving.

d. EEA 4. What driving tasks/subtasks or skills should be trained on a driver trainer?

(1) ARI guidelines for selecting tasks to be trained on a training device were applied to the driving tasks. A complete description and tabulation of this process is contained in Appendix D.

(2) A panel of SMEs was convened to rate driving tasks using the ARI criteria. The results of that board and input from driver and TC questionnaires were used in selecting tasks to be trained on the driver trainer. As a result of that process, no tasks/subtasks were selected for training via simulation on a training device. Separate tabulations were made for active army and RC units. In each tabulation, no tasks were selected for simulation training. Primary factor in negating selection was drivers' rating tasks as somewhat easy to very easy to perform.

(3) Combined tabulation of active army and RC units indicated 76% agreed the simulator would be useful in training new drivers (91% in NG). With the combined tabulation, 52% indicated the device would be used for sustainment training with an additional 15% unsure of its use in this category. When tabulated separately, 73% of NG respondents favored the device for sustainment. If the device were available, 76% desired the device to train for possible malfunctions including thrown track, fire in engine compartment, loss of steering, etc. Comments on those items dealing with the simulator appear in questionnaires at Appendix B.

(4) Seventy-seven percent of the command and supervisory personnel endorsed sustainment training on a driver trainer. Further inquiry revealed adequate time for driver training on the

vehicles is already a problem. An allocation for additional time in the unit training schedule for using a simulator is highly unlikely at this time.

e. EEA 5. What alternatives are available for driver training?

(1) Films, video tapes, mock-ups of driver stations, static training displays, and in-depth use of available publications such as Selection of Tracked Combat Vehicle Drivers, Manual for Tracked Combat Vehicle Drivers, and the M113 Technical Manual are viable supplements to driver training. These publications are valuable for the development of good drivers. Active use of the driver selection battery of tests, defensive driving courses, and other such supplements offered by post or unit safety offices are highly recommended.

(2) With regards to tactical driver training, it was suggested that after a sandbox explanation to introduce drivers to various platoon formations and maneuvers, training could proceed by using jeeps in a large field and at a later time proceed with tactics on the actual vehicles.

(3) The subject of driver training on a surrogate vehicle was contemplated, but rejected owing to the relatively low O&S cost of the M113. Fielding of the M113A3 with a steering yoke replacing the lateral arrangement now in vogue will simplify transfer of previous driving experience on automobiles to the larger mass of the tracked combat vehicle and present easy transfer to other similarly equipped tracked vehicles of this type.

f. EEA 6. What is the cost of present driving instruction at the institution and in the units?

(1) Costs of vehicle operation.

(a) O&S cost data supplied by TACOM indicated CONUS operations of 1,000 miles a year per vehicle at a cost of $13.40 per mile. This cost includes spares, petroleum/oil/lubricants (POL) and training ammunition. When military personnel, depot maintenance, modification, other direct and indirect support are included the O&S is estimated at $76.15 per mile.

(b) Fuel consumption for the M113 FOV is 3.15 miles per gallon. This is based on a 300 mile range with a 95 gallon fuel capacity.

(c) Vehicle acquisition costs in FY86 dollars are as follows:

M106A2		n/a *
M113A2		$184,003
M125A2	(less mortar)	224,701
M577A2		212,500
M901A1	(less TOW equipment)	398,543

* It is asssumed that the acquisition cost of this mortar carrier is comparable to the M125A2 Mortar Carrier.

(d) Table 12 depicts the current and projected OpTempo limits as provided by TACOM data. No reasons for the fluctuations in OpTempo were provided. Note the 65% reduction in Army Reserve OpTempo in the period from 1984 to 1987 and the NG OpTempo reduction of some 49% during the same time span. Unit mileage allocation is increased; however, if iterations at NTC are incorporated in the unit training plan.

Table 12

OPERATING TEMPO FOR M113 FAMILY OF VEHICLES
(IN MILES P/YEAR P/VEHICLE)

COMMAND	1984	1985	1986	1987	1988-91
FORSCOM	1000	850	850	805	1000
USAREUR	1000	850	850	805	850
WESTCOM	1000	850	850	805	850
TRADOC	1000	850	850	805	1058
NATL GUARD	600	510	306	290	306
ARMY RES	600	510	213	201	213

(2) Institution Driver Training Costs.

(a) Infantry OSUT at Ft Benning was considered typical of the M113 driver training conducted at other OSUT locations. Enrollment projections for Infantry OSUT were obtained from the scheduling branch of the U.S. Army Infantry Training Center, Ft Benning, GA and are contained in Table 13.

Table 13

ENROLLMENT PROJECTIONS FOR INFANTRY OSUT AT FT BENNING

FY	PROJECTION
1987	23,992
1988	23,986
1989	19,939

(b) Average class size is 200 soldiers. Driving instruction is conducted for one-half of the class on 1 day while the other half receives the same instruction on a subsequent day. Each student is charged with 3.4 miles of vehicle operation--two miles of actual driving and 1.4 miles of movement of the vehicle to the training site. The O&S cost of $13.40 per mile, as provided by TACOM, equates to a cost of approximately $46 per student for driving instruction (3.4 miles x $13.40 per mile). The estimated cost of driving instruction for Infantry OSUT using vehicles only is contained in Table 14.

Table 14

ESTIMATED COST OF DRIVING INSTRUCTION FOR INFANTRY OSUT (VEHICLES ONLY)

FY	ENROLLMENT PROJECTION	COST
1987	24,000	$1.1M
1988	24,000	$1.1M
1989	20,000	$ .9M

(3) Unit.

(a) Drivers estimated the number of miles they drove each month. Fifty-three percent estimated they drive between ten to 30 miles per month, which is consistent with average odometer readings. Twelve percent responded that they drove five miles per month, 6% drove 60 miles per month, 12% drove 100 miles per month and 18% did not respond to this item. Drivers estimated the percentage of driving devoted to three main categories of activity--driving in FTXs, ARTEPS, Gunnery; motor pool/road marches, and

driver training. These estimates are identified in Table 15. The estimate of 10% of vehicle operation for driver training may be high, as 25% of respondents indicated no mileage devoted to driver training.

Table 15

ALLOCATION OF VEHICLE MILEAGE IN THREE DRIVING CATEGORIES

CATEGORY	PERCENTAGE OF VEHICLE MILEAGE NG	FORSCOM
FTX, ARTEP, Gunnery	85	40
Road marches and motor pool	10	50
Driver training	5	10

(b) Costs of driver training in a mechanized infantry battalion are contained in Table 16. Using the FORSCOM/USAREUR/ WESTCOM 1986 average monthly vehicle OpTempo allocation (71 miles per month) times the estimated 10% devoted to driving instruction, results in 7.1 miles per month allotted to this activity. The cost of training one driver would then equate to approximately $95 per month (7.1 x $13.40). A "J" series mechanized infantry battalion with 112 tracked combat vehicles could expect driver training to cost approximately $10K per month (112 x $95) or $128K per year.

Table 16

COST OF DRIVER TRAINING IN A "J" SERIES MECHANIZED INFANTRY BN (USING VEHICLE ONLY)

# OF DRIVERS	COST PER DRIVER PER MONTH	TOTAL COST PER YEAR
112	$95	$128K

(c) No reduction in vehicle operation was perceived by 57% of FORSCOM and 67% of NG command and supervisory personnel, if a driver trainer were available. Of the 43% FORSCOM responses that vehicle use would be reduced, estimates of the percentage of

reduction ranged from 10 to 70 percent with no consensus. NG responses estimated a 50% reduction.

(d) Based on collected data, NG M113 FOVs are averaging 26.2 miles per month. Average monthly mileage was computed by dividing the current odometer reader as of April 1986 by number of months in service. This average is comparable to the projected OpTempo limit of 24 miles per month per vehicle (1986 annual OpTempo for NG divided by 12 months).

(e) M113s in FORSCOM units averaged 72 miles per month based on current odometer reading divided by months vehicle was in service. The average monthly mileage for all vehicles was added and divided by the number of vehicles to arrive at the average miles per month for the FOVs. This closely compares to the average monthly OpTempo for FORSCOM of 70.8 miles (annual FY86 OpTempo for FORSCOM divided by 12 months). Budget restrictions precluded obtaining the necessary vehicle use data from USAREUR and WESTCOM units.

g. EEA 7. What is the estimated cost of a driver trainer?

(1) Estimated costs at a rough order of magnitude for three classes of driver trainers had been provided by PM TRADE for the M2/M3 Bradley Fighting Vehicle Driver Trainer TDS. That agency indicated that the costs provided for that study would apply to the current effort and are at Appendix C. The driver trainers under consideration were a non-mobile, classroom type housed in a structure.

(a) A part task trainer was projected to be of low complexity, capable of replicating the procedures for starting, stopping, engine revolutions per minute control, braking, and turning. The device would be a single-station unit and considered a low cost risk. Visual presentation would be a fixed, pre-recorded line of travel. This device would permit introductory training. However, based on the description provided and projected activity to be incorporated in the device, no decrease was evident in vehicle usage for driver training.

(b) A limited task trainer would be of mid-complexity with full interaction for all cockpit switches, indicators, and controls for steering, acceleration, braking, and turning. An interactive visual display with a limited field of view would provide a selected roadbed and some off-road terrain, but no tactical driving capabilities. A single-station unit would operate with a model board. Use of computer generated imagery (CGI) with the limited task trainer would permit a multi-station configuration capable of training six soldiers at one time. Reduction of vehicle use for driver training, if the limited task trainer were available, was not determined.

(c) A full task trainer would permit interaction with all switches, pedals, gauges, and indicators. Visual representation would include limited tactical maneuvering, terrain driving in all weather, day or night. A full motion system (pitch and yaw) would limit the device to training one soldier at a time. Use of a limited motion system and CGI would permit a multi-station facility to train up to six soldiers at one time. This device would come nearest to replicating actual vehicle motions and experiences than any other device. Fidelity of the device (the degree to which the device replicates the actual vehicle) is considered a critical training element by most simulation training authorities.

(2) Cost comparison of the three classes of driver trainers is presented in Table 17. Cost of the device increases with the complexity of the tasks to be trained. A full task trainer with full motion system would be the most expensive type. Housing of the device, power requirements, soundproofing, and heating and air conditioning are other factors not costed.

Table 17

COST COMPARISON ESTIMATE OF THREE CLASS OF DRIVER TRAINERS

TYPE OF TRAINER	# OF TRG STATIONS	- - - ONE UNIT - - - R&D	O&S[1]	- - - R&D - - - 50 UNITS	70 UNITS
Part task	1	$ .2M	$.05M - .3M	$ 6.2M	$ 8.4M
Limited task	1	$ 4.0M	$.5M - 1.5M	$ 12.5M	$ 16.8M
	6	$ 8.0M	$.5M - 1.5M	$ 50.0M	$ 71.0M
Full task	1	$10.0M	$2.3M	$312.0M	$420.0M
	6	$14.0M	$2.3M	$ 87.0M	$106.0M

[1] O&S is per unit per year and includes all support activity. A range of O&S cost was established dependent on location of the device and maintenance personnel requirements. No change in O&S is anticipated with regards to the number of units purchased.

h. EEA 8. What are the estimated comparative costs of driver training using actual vehicles and a driver trainer?

(1) Institution. As no testing of driving skill is conducted in Infantry OSUT, a part task trainer could be a training alternative for this block of instruction. It was estimated that ten part task trainers could replace the ten M113s.

Non-operational vehicles could be used for the PMCS block of instruction. APCs would then be required only for the squad attack portion of the course. Purchase price of ten part task trainers is estimated at $1.2M (10 x $.12M each). Worst case O&S cost is based on the PM TRADE estimate of $.3M per year per device. Based on O&S costs only, Table 18 compares the estimated cost of driver training for Infantry OSUT using the part task and full task trainers versus vehicles.

Table 18

COMPARISON OF SIMULATOR VERSUS VEHICLE TRAINING COSTS FOR INFANTRY OSUT

		O&S		
FY	ENROLLMENT PROJECTION	VEHICLE ONLY	PART TASK SIMULATOR	FULL TASK SIMULATOR
1987	24,000	$1.1M	$3M	$23M
1988	24,000	$1.1M	$3M	$23M
1989	20,000	$ .9M	$3M	$23M

Note. Vehicle only costs were determined by multiplying the enrollment projection by the cost per student ($46). Simulator cost was determined by multiplying the estimated O&S cost per device by ten simulators.

(2) Unit.

(a) Annual cost of driver training on vehicles in a "J" series mechanized infantry battalion was compared to driver training on a full task, full motion simulator. This device has the potential for training approximately 70% of the driver tasks/subtasks previously identified. Those tasks/subtasks that would still require the actual vehicle are: start track using auxiliary start, start track using tow start, swim the track, drive track in wedge formation, drive track in vee formation, drive track in line formation, drive track in echelon formation, drive track to a coil halt, drive track to a herringbone halt, tow a disabled vehicle, and leave/enter a concealed/camouflaged position. Cost comparison of training on a simulator versus training on the actual vehicle is in Table 19. As is readily discernable, no savings of training dollars are evident by using a full task simulator.

Table 19

COMPARISON OF SIMULATOR VERSUS VEHICLE TRAINING COSTS PER YEAR FOR A MECHANIZED INFANTRY BATTALION

# OF DRIVERS	-O&S- VEHICLE ONLY	FULL TASK SIMULATOR
112	$.13M	$2.3M

Note. Vehicle only O&S for driver training was estimated by taking 9% of per vehicle montly mileage multiplied by O&S per mile by the number of primary tracked vehicle drivers in the battalion. Use of the full task simulator is a low side estimate of driver training costs as several tasks would still require operation of the actual vehicle which imposes an additional training cost.

(b) It is evident there would be no significant reduction in the battalion's O&S cost by using a full task simulator, and more than likely, would cause an increase in this expenditure. Use of a part task simulator for driver training was deemed not appropriate for the extent of training required by combat ready units.

(c) Projected use of one driver trainer at three levels of deployment is depicted in Table 20.

Table 20

PROJECTED USE OF ONE TRACKED VEHICLE DRIVER TRAINER AT THREE LEVELS OF MECHANIZED INFANTRY DEPLOYMENT

HOURS ON SIMULATOR	DAYS TO TRAIN BN	BDE	DIV
4	56	112	280
8	112	224	560

(d) Allotting 4 hours of simulation time per driver, all drivers in a battalion could receive the necessary instruction in 56 training days. With the device located at brigade level, tracked vehicle drivers for the two mechanized Infantry battalions could be trained in 112 days. Increasing simulation time to 8 hours per driver would double the use of the devices. Based on foreign armies' use of driver trainers, 8 hours of simulation appears to be more than adequate for the typical soldier. A basis of issue plan (BOIP) of one driver trainer per battalion would result in the device being idle for extended periods, but provide ease of access for the unit during appropriate training periods. With the device at brigade level and 8 hours of simulation for the two mechanized infantry battalions' tracked vehicle drivers would permit excellent use of the device but present scheduling difficulties. Considering an 8-hour training day, use of one device at division level would not permit training of all primary drivers during a 1-year time span necessitating two devices at this level. This would lead to extended periods of inactivity for the devices and possible scheduling problems.

7. CONCLUSIONS.

a. No consensus was reached on specific performance deficiencies in driving tasks or subtasks by M113 FOV drivers.

b. No tasks were selected for training on a driver trainer using an ARI process with data from drivers, TCs and SMEs.

c. No savings of training dollars would occur in using driver trainers in either the institution or in mechanized units.

d. Units are pressed for adequate time to allocate for driver training whether it be on a simulator or on the tracked vehicle.

e. Minimum or no reduction in vehicle operation would occur if a driver trainer were available as most driver training is conducted by on-the-job-training.

f. Use of a driver trainer could present more standardized driving instruction and an objective assessment of a driver's proficiency in controlling the vehicle.

g. RC mechanized units do not have adequate local training sites for driver training. However, once drivers are licensed, they tend to remain in that position for several years providing continuity of proficiency and experience.

h. If a driver trainer were available for the RC, the device would be idle for as much as 28 days each month.

8. RECOMMENDATION: Efforts to procure a driver trainer for the M113 family of vehicles should be discontinued.

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